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(54) **MANAGING SHARED INVENTORY IN A VIRTUAL UNIVERSE**

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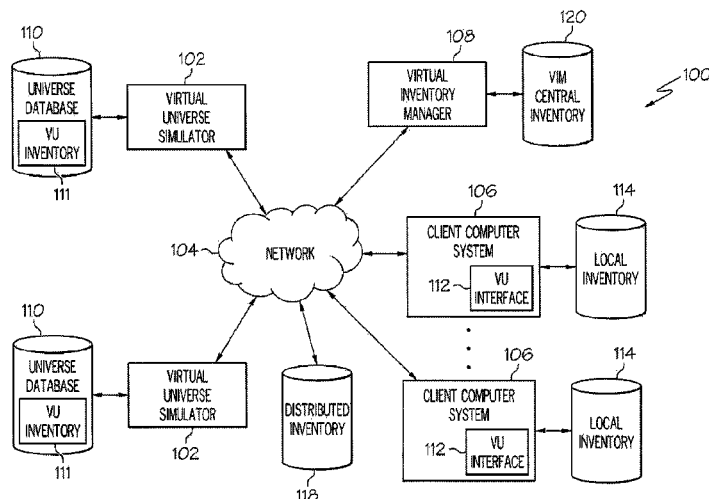
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(57) **ABSTRACT**

Generally speaking, systems, methods and media for managing shared inventory in a virtual universe are disclosed. Embodiments of the method may include receiving notification of a user session being established between a user and a virtual universe simulator. The method may also include accessing a list of shared inventory items for the user where the list of shared inventory items includes one or more shared inventory items each having an inventory source associated with it. Embodiments may also include retrieving at least one shared inventory item from its associated inventory source and passing the retrieved shared inventory item to the virtual universe simulator. Further embodiments may include retrieving an updated listing for the shared inventory items from their associated inventory sources and passing the updated shared inventory item list to the virtual universe simulator. Further embodiments may include passing meta-data for shared inventory items to the virtual universe simulator.

**22 Claims, 7 Drawing Sheets**



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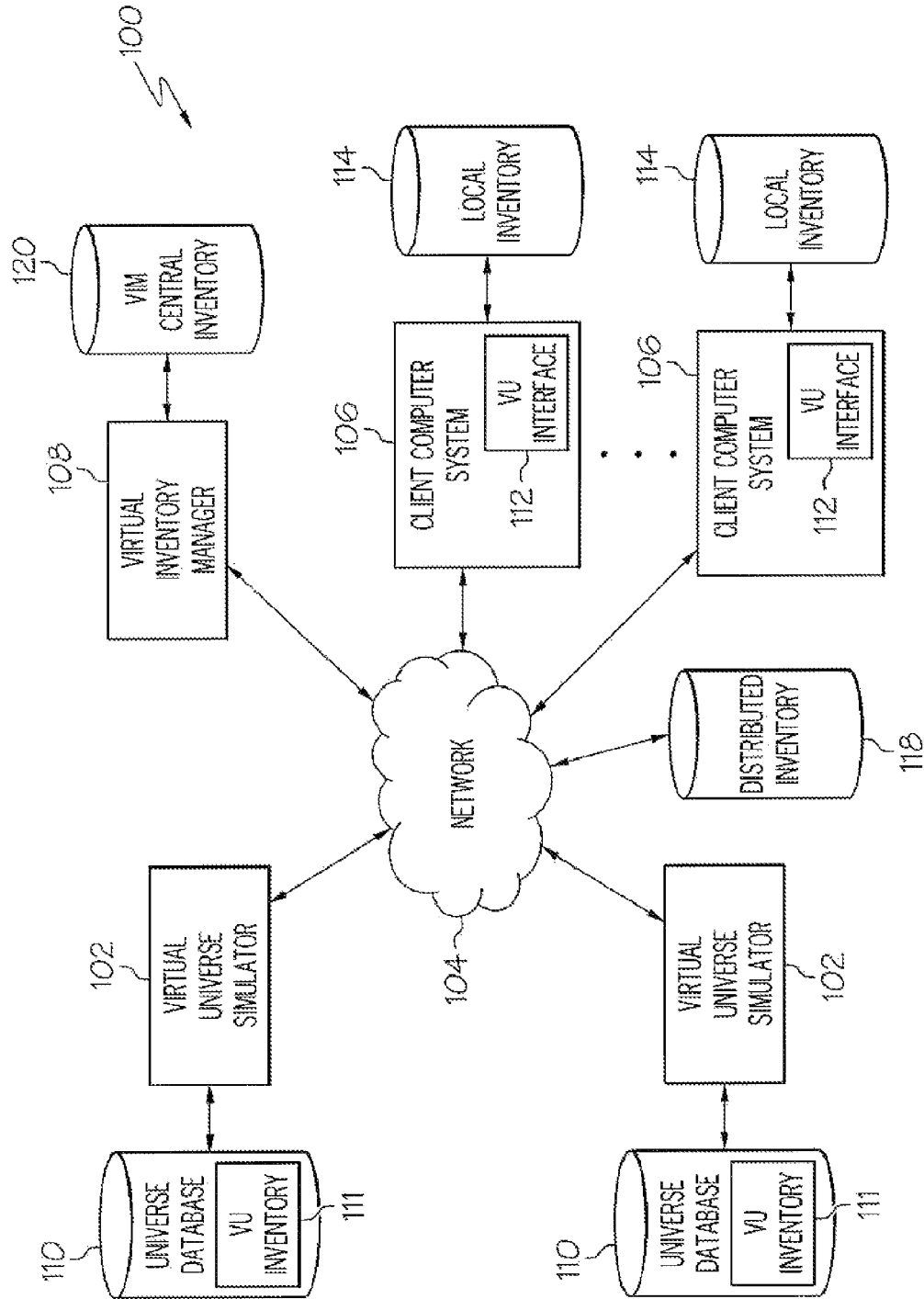


FIG. 1

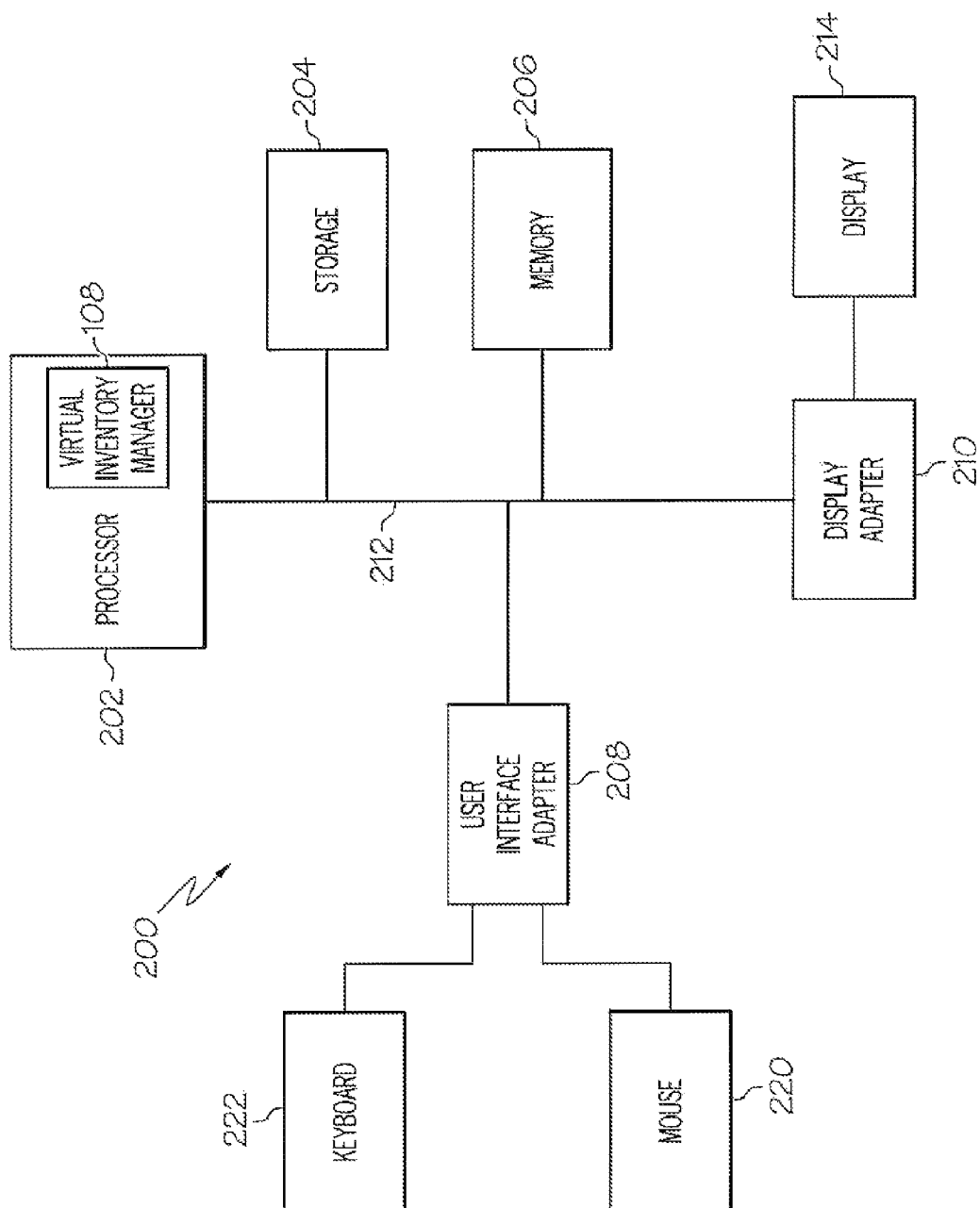


FIG. 2

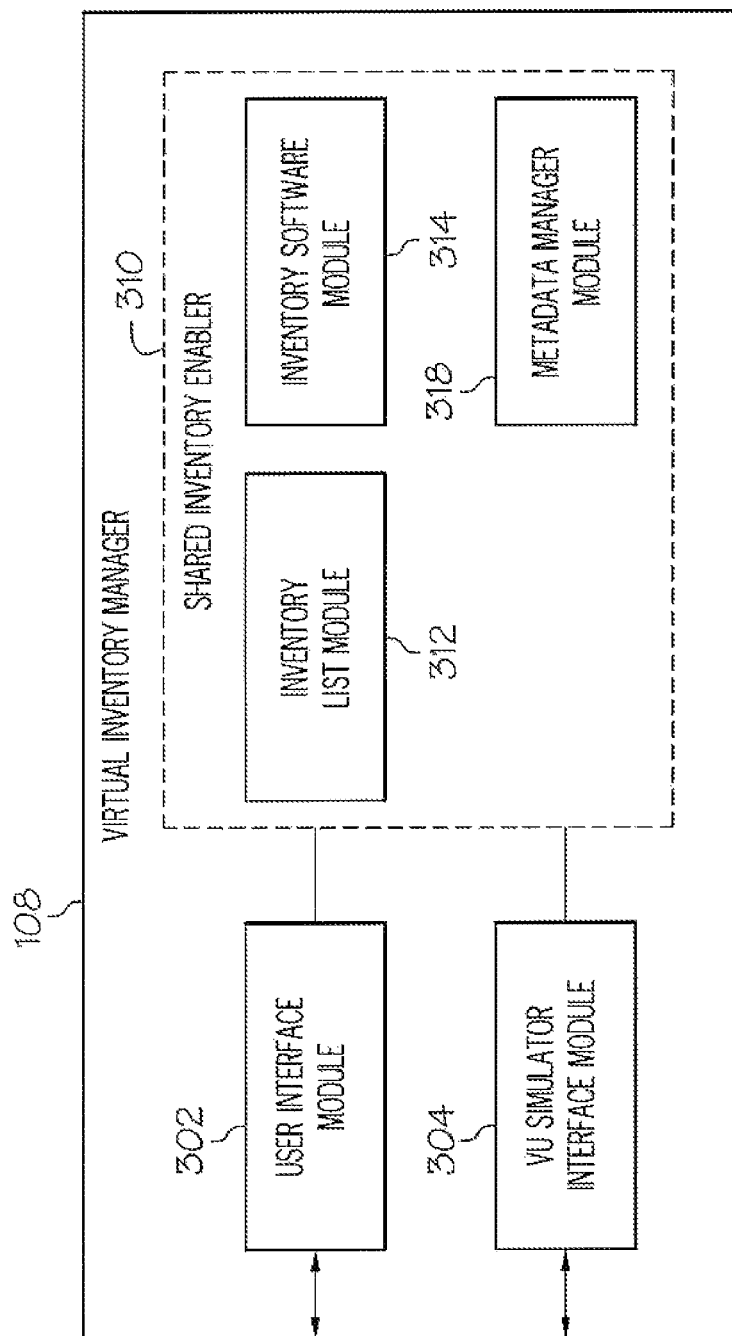


FIG. 3

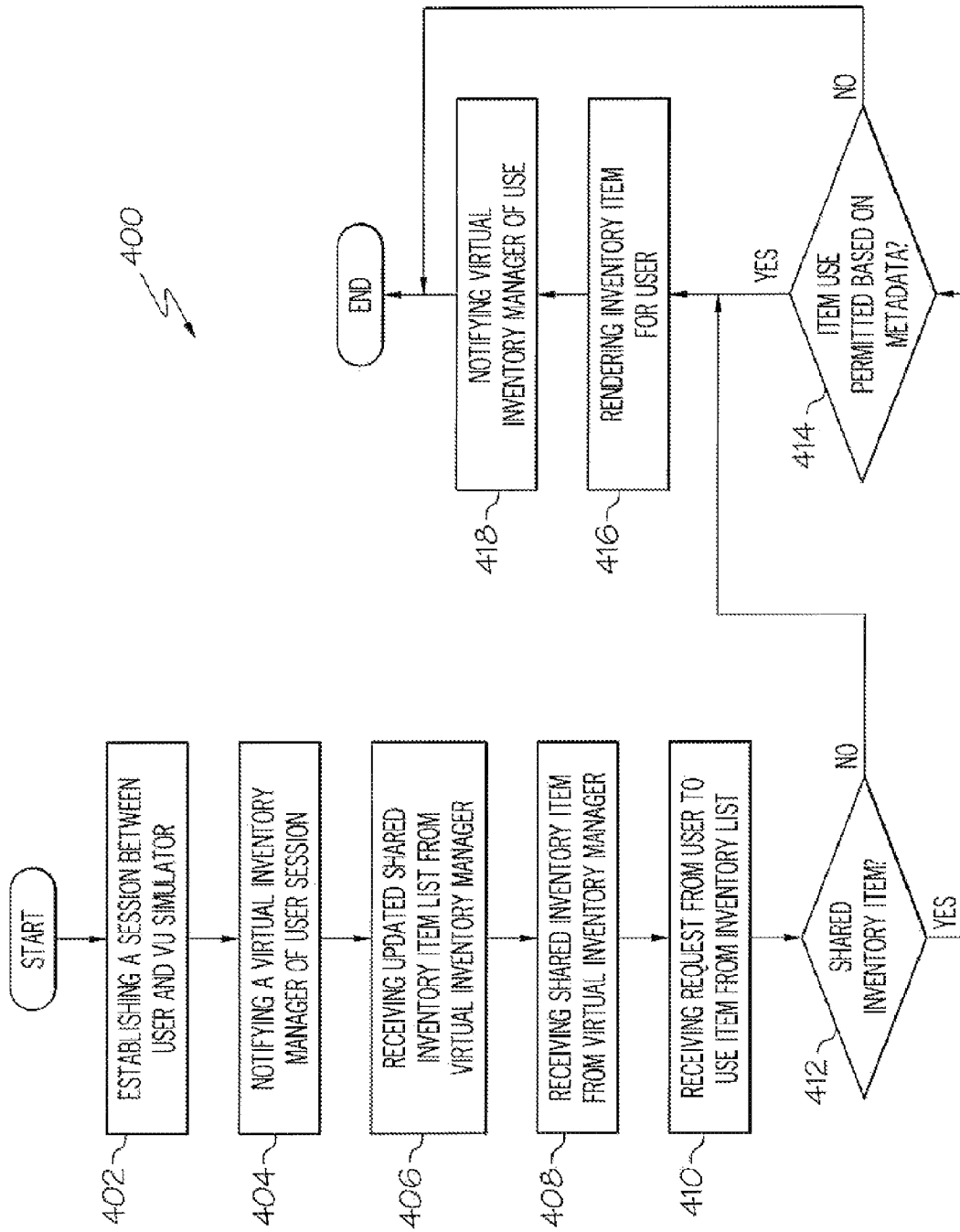


FIG. 4

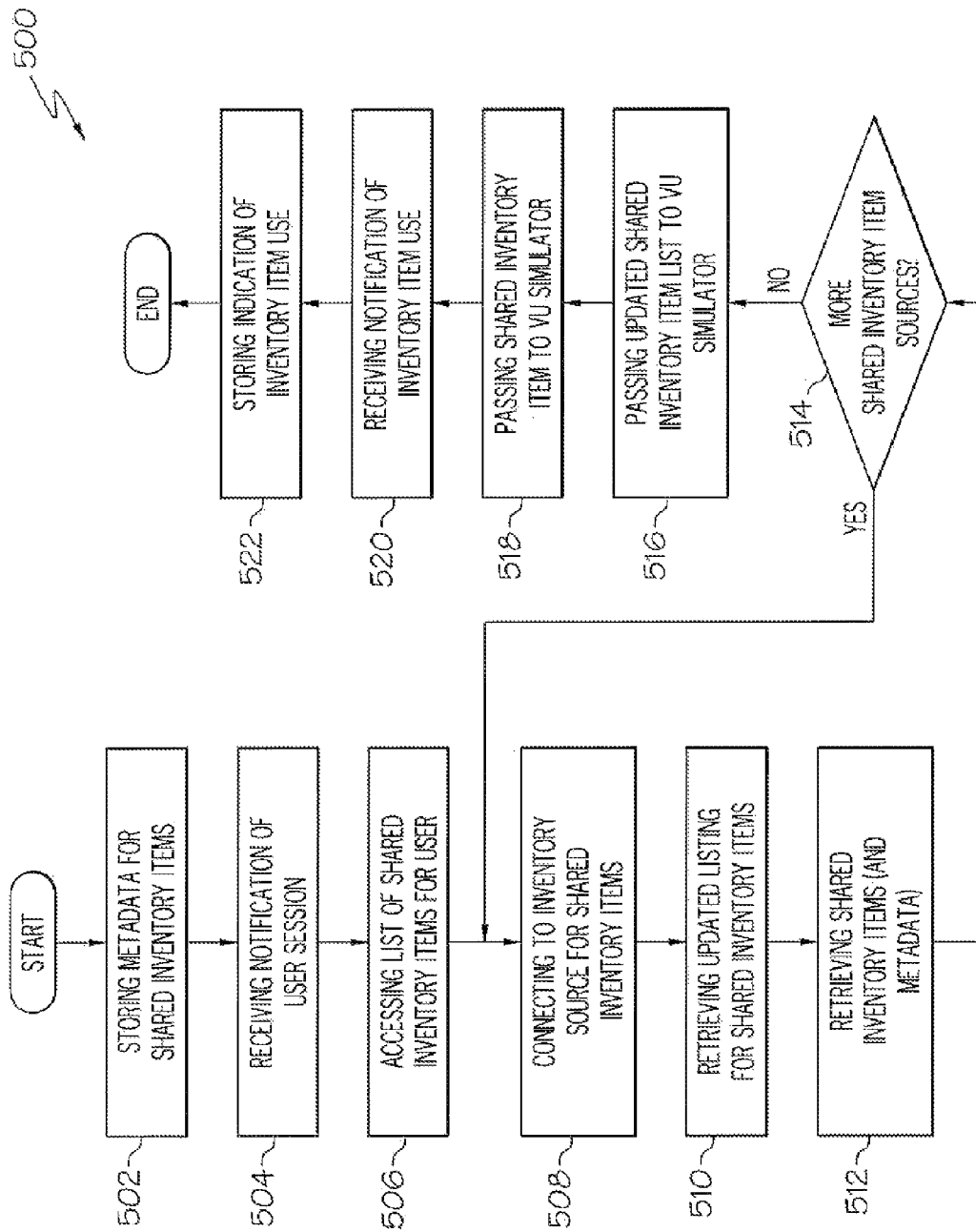


FIG. 5

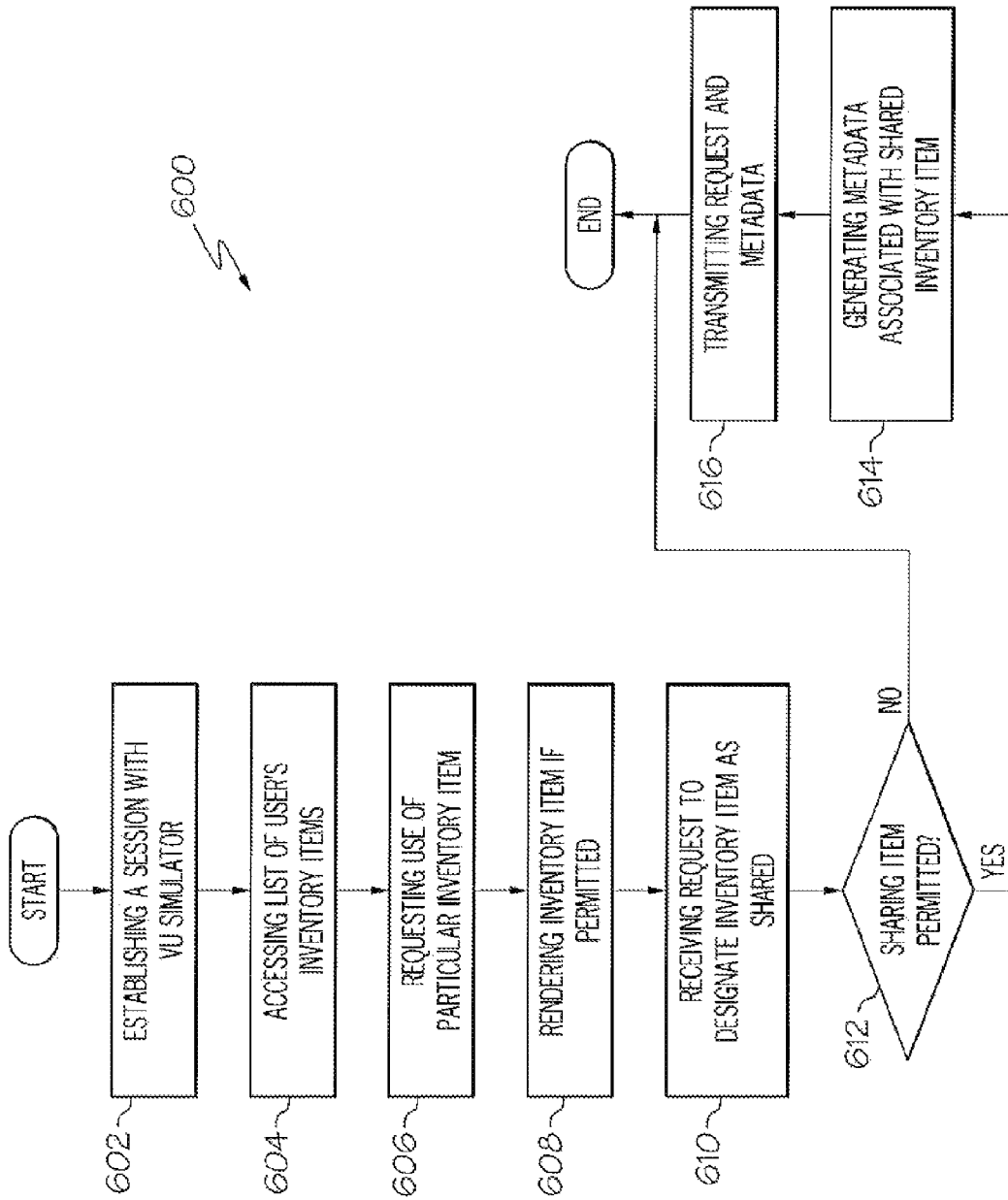


FIG. 6



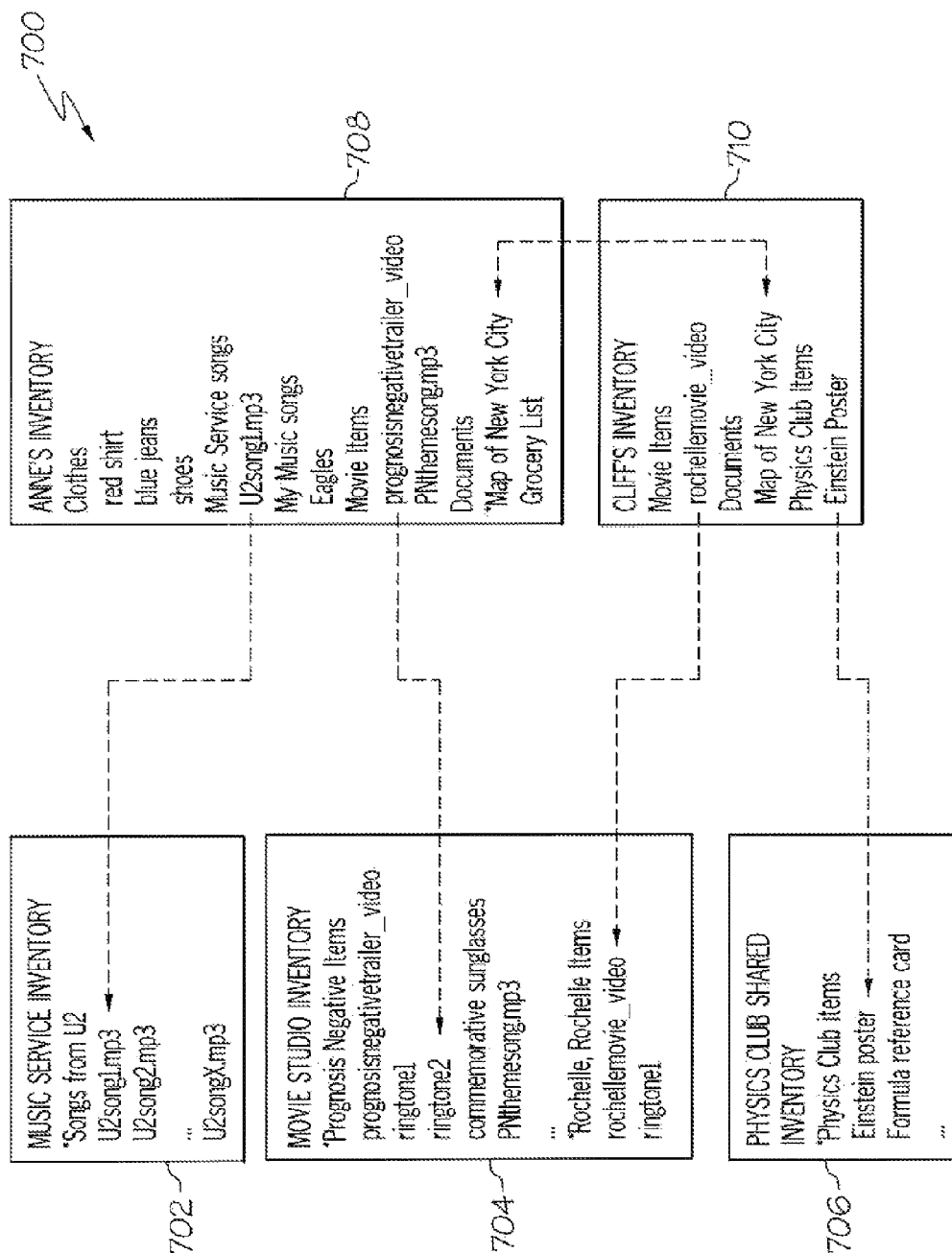


FIG. 7

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## MANAGING SHARED INVENTORY IN A VIRTUAL UNIVERSE

### FIELD OF INVENTION

The present invention is in the field of data processing systems and, in particular, to systems, methods and media for managing shared inventory in a virtual universe.

### BACKGROUND

Computer systems are well known in the art and have attained widespread use for providing computer power to many segments of today's modern society. As advances in semiconductor processing and computer architecture continue to push the performance of computer hardware higher, more sophisticated computer software has evolved to take advantage of the higher performance of the hardware, resulting in computer systems that continue to increase in complexity and power. Computer systems have thus evolved into extremely sophisticated devices that may be found in many different settings. Computer systems are often connected to the Internet or other broad-based network in order to communicate with other computer systems, access information or other resources, or perform various tasks associated with business, personal bankings electronic commerce transactions, or other endeavors.

One application for computer systems that is increasing in importance is for use in accessing virtual universes (VUs), which are also known as virtual worlds and virtual world environments (VWEs). A VU represents a real or imaginary place using graphics, images, video, auditory data, or other sensory data to define a representation on a computer system to one or more users. The hardware and software that together create a VU provide the ability for users to interact with, the VU in various ways, VUs commonly allow for multiple users to simultaneously interact with the VU, allowing the users to thus interact with each other within the VU and form a community. Current VUs such as Second Life® by Linden Lab or There® by Makena Technologies provide an interactive, three-dimensional (3D) online digital world with hundreds of thousands of users accessing the world via the Internet. In these graphical VUs, users typically are represented by an avatar within the online world, and the users may command their avatar to move within the VU, communicate with other users via their avatars, etc., and thus interact with the virtual world, VUs typically allow users (using a client program on their computer system) to use various tools to view, navigate, and modify the virtual world as well as participate in its virtual economy.

VU users typically have an inventory of items, that they own, and these inventory items may be bought, sold, traded, etc, during operation of the VU. Items in a typical inventory may include clothing, virtual pets, vehicles, electronic media (e.g., music files), or other possessions. Each inventory item may represent a piece of code or other data which may be rendered in some fashion to the user during a session in the VU. Clothing inventory, for example, may be rendered as clothing for the user's avatar while a virtual dog, in another example, may render as an automated avatar that follows the user's avatar within the VU. The contents of a user's inventory are typically displayed in a hierarchical manner similar to an operating system's display of folders, subfolders, and files within a filesystem.

The current use of inventories within a VU is limited. Individuals must typically manage their own inventories, manually adding or deleting inventory items from their inven-

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tory. Also, since each inventory item often has software code necessary to render it, the stored code results in significant storage and maintenance requirements within the VU as each instance of code is stored separately. The cost of purchasing or otherwise acquiring many inventory items is also sometimes prohibitive for many users. Another problem with current inventory systems is that sharing of inventory items is not available. A user wishing to loan an inventory item to another, for example, loses control of that item, making such a loan undesirable in many cases. For items such as artwork, the owner may want to retain some control over the item. For other items where control is not as important, a copy of an item can sometimes be made in order to facilitate exchange of items but this may result in excessive use of VU resources. The lack of sharing may thus exacerbate the storage problems associated with inventory items as the code must be stored for each individual user. Managing inventories has thus become a major problem in VU space as such inventories are increasingly taken up by functional software, documents, and other such items that today reside on local drives.

### SUMMARY OF THE INVENTION

The problems identified above are in large part addressed by systems, methods and media for managing shared inventory in a virtual universe. A method for managing shared inventory in a virtual universe is disclosed. Embodiments of the method may include receiving notification, of a user session being established between a user and a virtual universe simulator. The method may also include accessing a list of shared inventory items for the user where the list of shared inventory items includes one or more shared inventory items each having an inventory source associated with it. Embodiments may also include retrieving at least one shared inventory item from its associated inventory source and passing the retrieved at least one shared inventory item to the virtual universe simulator. Further embodiments may include retrieving an updated listing for the shared inventory items from their associated inventory sources and passing the updated, shared inventory item list to the virtual universe simulator. Further embodiments may include passing metadata for shared inventory items to the virtual universe simulator.

Another embodiment provides a computer program product comprising a computer-useable medium having a computer readable program wherein the computer readable program, when executed on a computer, causes the computer to perform a series of operations for managing shared inventory in a virtual universe. The series of operations generally includes receiving notification of a user session being established between a user and a virtual universe simulator. The series of operations may also include accessing a list of shared inventory items for the user where the list of shared inventory items includes one or more shared inventory items each having an inventory source associated with it. Embodiments may also include retrieving at least one shared inventory item from its associated inventory source and passing the retrieved at least one shared inventory item to the virtual universe simulator. Further embodiments may include retrieving an updated listing for the shared inventory items from their associated inventory sources and passing the updated shared inventory item list to the virtual universe simulator. Further embodiments may include passing metadata for shared inventory items to the virtual universe simulator.

A further embodiment provides a data processing system having a machine-accessible medium storing a plurality of program modules. Embodiments may include a virtual uni-

verse simulator interface module to facilitate communication to and from a virtual universe simulator and to receive notification of a user session to the virtual universe simulator being established. Embodiments may also include a shared inventory enabler module to manage shared inventory items in a virtual universe. The shared inventory enabler module may include an inventory list module to access a list of shared inventory items for the user that includes one or more shared inventory items each having an inventory source associated with it. The shared inventory enabler module may also include an inventory software module to retrieve at least one shared inventory item from its associated inventory source for passing to the virtual universe simulator.

#### BRIEF DESCRIPTION OF THE DRAWINGS

Aspects of certain embodiments of the invention will become apparent upon reading the following detailed description and upon reference to the accompanying drawings in which like references may indicate similar elements:

FIG. 1 depicts a virtual universe inventory system with one or more virtual universe simulators, one or more client computer systems, a virtual inventory manager and various inventory sources according to some embodiments;

FIG. 2 depicts a block diagram of one embodiment of a computer system suitable for use as a component of the virtual universe inventory system, such as a client computer system or a data processing system to execute the virtual inventory manager;

FIG. 3 depicts a conceptual illustration of software components of a virtual inventory manager according to some embodiments;

FIG. 4 depicts an example of a flow chart for rendering a shared inventory item in a virtual universe according to some embodiments;

FIG. 5 depicts an example of a flow chart for managing a shared inventory item in a virtual universe according to some embodiments;

FIG. 6 depicts an example of a flow chart for using and configuring shared inventory items in a virtual universe according to some embodiments; and

FIG. 7 depicts a schematic representation of inventory source lists and an inventory item list with shared inventory items according to some embodiments.

#### DETAILED DESCRIPTION OF EMBODIMENTS

The following is a detailed, description of example embodiments of the invention depicted in the accompanying drawings. The example embodiments are in such detail as to clearly communicate the invention. However, the amount of detail offered is not intended to limit the anticipated variations of embodiments; on the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the present invention as defined by the appended claims. The descriptions below are designed to make such embodiments obvious to a person of ordinary skill in the art.

Generally speaking, systems, methods and media for managing shared inventory in a virtual universe are disclosed. Embodiments of the method may include receiving notification of a user session being established between a user and a virtual universe simulator. The method may also include accessing a list of shared inventory items for the user where the list of shared inventory items includes one or more shared inventory items each having an inventory source associated with it. Embodiments may also include retrieving at least one

shared inventory item from its associated inventory source and passing the retrieved, at least one shared inventory item to the virtual universe simulator. Further embodiments may include retrieving an updated listing for the shared inventory items from their associated inventory sources and passing the updated shared inventory item list to the virtual universe simulator. Further embodiments may include passing meta-data for shared inventory items to the virtual universe simulator.

The system and methodology of the depicted embodiments allow for effective and efficient management of shared inventory in a virtual universe. By allowing users to share inventory items, users can retain some level of control over their property by placing restrictions on the use of the item by others according to some embodiments. The resources required to store and maintain various inventory items may also be reduced as the disclosed shared inventory system prevents wasteful duplicative storage of shared inventory items. A user may have in their inventory list a number of shared inventory items that are stored at a variety of locations, many remote, in this fashion, the shared inventory items need not be stored in a unique instance for each user sharing the item and can instead be efficiently stored in one location. A user who is offering an item for sharing may restrict sharing by others in a variety of ways, such as by putting time limits on others' usage, requiring for the others to first pay a fee, limiting how the other users may utilize the item, or other restrictions.

In general, the routines executed to implement the embodiments of the invention may be part of a specific application, component, program, module, object, or sequence of instructions. The computer program of the present invention typically is comprised of a multitude of instructions that will be translated by the native computer into a machine-readable format and hence executable instructions. Also, programs are comprised of variables and data structures that either reside locally to the program or are found in memory or on storage devices. In addition, various programs described herein may be identified based upon the application for which they are implemented in a specific embodiment of the invention. However, it should be appreciated that any particular program nomenclature herein is used merely for convenience, and thus the invention should not be limited to use solely in any specific application identified and/or implied by such nomenclature.

While specific embodiments will be described below with reference to particular configurations of hardware and/or software, those of skill in the art will realize that embodiments of the present invention may advantageously be implemented with other substantially equivalent hardware, software systems, manual operations, or any combination of any or all of these. The invention can take the form of an entirely hardware embodiment, an entirely software embodiment or an embodiment containing both hardware and software elements. In a preferred embodiment, the invention is implemented in software, which includes but is not limited to firmware, resident software, microcode, etc. Moreover, embodiments of the invention may also be implemented via parallel processing using a parallel computing architecture, such as one using multiple discrete systems (e.g., plurality of computers, etc) or an internal multiprocessing architecture (e.g., a single system with parallel processing capabilities).

Aspects of embodiments of the invention described herein may be stored or distributed on computer-readable medium as well as distributed electronically over the Internet or over other networks, including wireless networks. Data structures and transmission of data (including wireless transmission) particular to aspects of the invention are also encompassed

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within the scope of the invention. Furthermore, the invention can take the form of a computer program product accessible from a computer-readable medium providing program code for use by or in connection with a computer or any instruction execution system. For the purposes of this description, a computer-usable or computer readable medium can be any apparatus that can contain, store, communicate, propagate, or transport the program for use by or in connection with the instruction execution system, apparatus, or device. The medium may be an electronic, magnetic, optical, electromagnetic, infrared, or semiconductor system (or apparatus or device) or a propagation medium. Examples of a computer-readable medium include a semiconductor or solid state memory, magnetic tape, a removable computer diskette, a random access memory (RAM), a read-only memory (ROM), a rigid magnetic disk and an optical disk. Current examples of optical disks include compact disk-read only memory (CD-ROM), compact disk-read/write (CD-R/W) and DVD.

Each software program described herein may be operated on any type of data processing system, such as a personal computer, server, etc. A data processing system suitable for storing and/or executing program code may include at least one processor coupled directly or indirectly to memory elements through a system bus. The memory elements may include local memory employed during execution of the program code, bulk storage, and cache; memories which provide temporary storage of at least some program code in order to reduce the number of times code must be retrieved from bulk storage during execution, input/output (I/O) devices (including but not limited to keyboards, displays, pointing devices, etc.) may be coupled to the system either directly or through intervening I/O controllers. Network adapters may also be coupled, to the system to enable the data processing system to become coupled to other data processing systems or remote printers or storage devices through intervening private or public networks, including wireless networks. Modems, cable modems and Ethernet cards are just a few of the currently available types of network adapters.

Turning now to the drawings, FIG. 1 depicts a virtual universe (VU) inventory system **100** with one or more virtual universe simulators **102**, one or more client computer systems **106**, a virtual inventory manager **108** and various inventory sources according to some embodiments. In the depicted embodiment, the virtual universe inventory system **100** includes one or more virtual universe simulators **102** in communication with a plurality of client computer systems **106** via network **104**. The virtual universe simulator **102** and client computer systems **106** may also be in communication with a virtual inventory manager **108** via network **104**. A variety of possible inventory sources are also depicted, including VU inventory databases **111** for each virtual universe simulator **102**, local inventory databases **114** for each client computer system **106**, distributed inventory **118**, and a virtual inventory manager (VIM) central inventory **120**. As will be described in more detail subsequently, a virtual universe simulator **102** may manage a virtual universe (VU) by interacting with a variety of users of client computer systems **106** and the virtual inventory manager **108** may facilitate sharing of inventory items between various users of the client computer systems **106**. While a plurality of virtual universe simulators **102** and client computer systems **106** are depicted, one of ordinary skill in the art will recognize that the virtual inventory manager **108** may facilitate shared inventory items with either a single virtual universe simulator **102** or multiple simulators.

Inventory items may be any item that may be associated with a user in a virtual universe. Inventory items may each be

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comprised of one or more files, be part of a larger database, or be stored in any other fashion. In some embodiments, an inventory item may be a piece of software code that is renderable in a virtual universe. In other embodiments, inventory items may be represented as non-executable data that may be used by the VU to render the inventory item for the user when needed. Non-limiting examples of inventory items include graphics files, sound files, animations, electronic documents, video files, avatar clothing or accessories, avatar body parts, avatar tools or vehicles or other objects, avatar gestures, automated avatars, calling cards, landmarks (such as bookmarked locations) or other geographical information, items in a lost and found folder, note cards, photos and photo albums, scripts (e.g., macros to perform actions), textures, deleted items, or any other type of item. One of ordinary skill in the art will recognize that inventory items may include executable code, non-executable data, or any other type of information, and may also represent any type of item within a VU.

Virtual universe simulator **102** may be implemented on one or more servers or other computer systems (such as those described in relation to FIG. 2) adapted to implement all or part of a virtual universe. The virtual universe simulator **102** may be implemented, for example, on one or more application servers such as International Business Machine's (IBM®'s) WebSphere® Application Server (WAS) that may serve as middleware to set up, operate, and integrate e-business applications across multiple computing platforms using Web technologies. The virtual universe simulator **102** may provide a virtual universe to users by accessing stored information from a database and creating and operating a virtual universe based on the stored information. To accomplish this, the virtual universe simulator **102** may render the virtual universe, including a user's inventory items, on the client computer system **102** so that the user can view or otherwise experience the virtual universe. An example virtual universe simulator **102** may include massively multiplayer online games such as the Second Life® virtual world from Linden Lab or There® by Makena Technologies.

A virtual universe simulator **102** may also have a universe database **110** to store a variety of files used to create, maintain, and operate a virtual universe (collectively "environment information"), such as graphics files (e.g., buildings, avatars, landscapes, items, etc.), sound files (e.g., environmental sounds, spoken words, etc.), or text files (e.g., configuration information, descriptive information for objects, user information, etc.). The universe database **110** may include a VU inventory database **111** storing shared inventory items and/or information relating to shared inventory items, such as item metadata. Shared inventory items, much like traditional inventory items, may be rendered within a virtual universe. The VU inventory database **111** may be wholly or partially a separate database from the universe database **110** or it may be integrated within the universe database **110** as depicted. The universe database **110** and VU inventory database **111** may each be stored on any type or combination of storage devices, including volatile or non-volatile storage such as hard drives, storage area networks, memory, fixed or removable storage, or other storage devices.

Users may utilize a client computer system **106** according to the present embodiments to access the virtual universe simulator **102** (and thus the virtual universe) via network **104**. Client computer system **106** may be a personal computer system or other computer system adapted to execute computer programs, such as a personal computer, workstation, server, notebook or laptop computer, desktop computer, personal digital assistant (PDA), mobile phone, wireless device, or set-top box, such as described in relation to FIG. 2. A user

of the client computer system **106** may utilize a VU interface **112** to interact with the VU operated by the virtual world simulator **102**. VU interface **112** may be dedicated client software provided by the VU operator in some embodiments or it may alternatively be existing general software such as a browser.

The client computer system **106** may optionally have a local inventory database **114** to store shared inventory items and/or information relating to shared inventory items, such as item metadata. The local inventory database **114** may be stored on any type or combination of storage devices, including volatile or non-volatile storage such as hard drives, storage area networks, memory, fixed or removable storage, or other storage devices. A local inventory database **114** may be useful when a user stores some of their inventory items locally, including items that they may make available for sharing. In some embodiments, a local inventory database **114** is not needed and inventory items are stored in other inventory sources such as the VU inventory database **111**.

Network **104** may be any type of data communications channel or combination of channels, such as the Internet, an intranet, a LAN, a WAN, an Ethernet network, a wireless network, telephone network, a proprietary network, or a broadband cable network. In one example, the Internet may serve as network **104** and the client computer systems **106**, the virtual inventory manager **108**, and the virtual universe simulator **102** may communicate via the Internet using known protocols. Those skilled in the art will recognize, however, that the invention described herein may be implemented utilizing any type or combination of data communications channel(s) without departure from the scope and spirit of the invention.

The virtual inventory manager **108**, as will be described in more detail in relation to FIG. 3, may manage shared inventory items for one or more virtual universe simulators **102** (and thus one or more virtual universes). In some embodiments, the virtual inventory manager **108** may facilitate the Copying of a shared inventory item from an inventory source to the virtual universe simulator **102** when the shared inventory item is requested. By facilitating such copying, the virtual inventory manager **108** allows the virtual universe simulator **102** to avoid having to store a copy of a shared inventory item for each instance of a user having rights to the item. In an example, a user may have multiple items in her inventory, some of which are shared inventory items. The shared inventory items may be represented as pointers or references to the shared inventory item that is stored at a remote inventory source as part of a shared managed inventory. When the user checks her inventory (or at an earlier time), the virtual inventory manager **108** may in effect access the remote shared, inventory item and provide that shared inventory item to the virtual universe simulator **102**, which, may in turn render the Inventory item to the user. From the point of the view of the user, it will appear in this example as if the item had been in her inventory all along. The virtual inventory manager **108** may also optionally cache some or all shared inventory items and query inventory sources periodically for new or updated items in order to improve its efficiency.

The virtual inventory manager **108** may optionally include a VIM central inventory database **120** to store shared inventory items related information. The VIM central inventory database **120** may be stored on any type or combination of storage devices, including volatile or non-volatile storage such as hard drives, storage area networks, memory, fixed or removable storage, or other storage devices. In some embodiments, shared items may be stored on the VIM central inventory database **120** instead of a VU inventory database **111** associ-

ated with a virtual universe simulator **102** or a local inventory database **114** of a user. The VIM central inventory database **120** may be particularly useful for situations where a virtual universe operator does not want to manage shared resources or for when inventory items may be shared across multiple virtual universes. A user may, for example, wish to use and share inventory items in multiple virtual universes to which they belong and a centralized database to store such items may provide efficiency benefits.

A virtual inventory manager **108** may be operated by a virtual universe simulation owner, a third party provider, or other entity. The virtual inventory manager **108** may also have a VIM Application Programming Interface (API) to facilitate access to and from any virtual universe simulator **102**, which may be particularly useful for third party-managed virtual inventory managers **108**. Once a VIM API is established, a virtual universe simulator **102** that wishes to take advantage of the services of a virtual inventory manager **108** can ensure compatibility and operability via use of the VMI API.

A distributed inventory database **118** is another option for an inventory source to store shared inventory items and related, information. A distributed inventory database **118** may be a separate database from any of the other components of the virtual universe inventory system **100**. A distributed inventory database **118** may be particularly useful for content providers, such as music or video distributors, that wish to maintain control of their content and potentially service multiple virtual universe simulators **102**. The distributed inventory database **118** may be stored on any type or combination of storage devices, including volatile or non-volatile storage such as hard, drives, storage area networks, memory, fixed or removable storage, or other storage devices.

According to some embodiments, the virtual inventory manager **108** may be considered an abstraction layer between traditional means of connecting data among servers and a virtual universe simulator-specific graphical user interface (GUI). The means of connecting data among servers may include network file system (NFS) applications, structured query language (SQL), file transfer protocol (ftp), a services-oriented architecture (SOA) request, or other methodologies. A particular, shared, inventory item may be stored at any inventory source within the virtual universe inventory system **100**, including on VU inventory databases **111**, local inventory databases **114**, distributed inventory databases **118**, or VIM central inventory databases **120**. While many types of inventory sources are depicted, one of ordinary skill in the art will recognize that not all depicted, inventory sources are required and that only one inventory source would be sufficient according to the present embodiments. As described previously, the virtual inventory manager **108** may access a particular shared inventory item from its original location and provide it to a virtual universe simulator **102** so that a user with the appropriate permissions can access the shared inventory item regardless of its original location.

Various non-limiting examples may serve to further illustrate the disclosed virtual universe inventory system **100**. In one example, a user of a client computer system may wish to share an inventory item stored in their local inventory database **114** with other users of their virtual universe. By designating the inventory item as shareable, other users will be able to enjoy the inventory item during their own user sessions in the virtual universe as the virtual inventory manager **108** will facilitate copying the original inventory item as needed so that the item renders for the other users. The owning user may also limit the sharing in a variety of fashions, such as by using metadata to specify the terms and conditions of sharing. By retaining the only 'permanent' version of the item, according

to some embodiments, the owning user may have improved control over its use compared to current systems. In other example, a content provider may maintain a distributed inventory database **118** including multiple shareable inventory items. The content provider may potentially provide access to these items to many users across multiple virtual universe simulators **102** without having to distribute persistent copies of their content, providing possible advantages in protection of intellectual property.

FIG. 2 depicts a block diagram of one embodiment of a computer system **200** suitable for use as a component of the virtual universe inventory system **100**, such as a client computer system **106** or a data processing system to execute the virtual inventory manager **108**. Other possibilities for the computer system **200** are possible, including a computer having capabilities other than those ascribed herein and possibly beyond those capabilities, and they may, in other embodiments, be any combination of processing devices such as workstations, servers, mainframe computers, notebook or laptop computers, desktop computers, PDAs, mobile phones, wireless devices, set-top boxes, or the like. At least certain of the components of computer system **200** may be mounted on a multi-layer planar or motherboard (which may itself be mounted on the chassis) to provide a means for electrically interconnecting the components of the computer system **200**.

In the depicted embodiment, the computer system **200** includes a processor **202**, storage **204**, memory **206**, a user interface adapter **208**, and a display adapter **210** connected to a bus **212** or other interconnect. The bus **212** facilitates communication between the processor **202** and other components of the computer system **200**, as well as communication between components. Processor **202** may include one or more system central processing units (CPUs) or processors to execute instructions, such as an IBM® PowerPC™ processor, an Intel Pentium® processor, an Advanced Micro Devices Inc. processor or any other suitable processor. The processor **202** may utilize storage **204**, which may be non-volatile storage such as one or more hard drives, tape drives, diskette drives, CD-ROM drive, DVD-ROM drive, or the like. The processor **202** may also be connected to memory **206** via bus **212**, such as via a memory controller hub (MCH). System memory **206** may include volatile memory such as random access memory (RAM) or double data rate (DDR) synchronous dynamic random access memory (SDRAM). In the disclosed systems, for example, a processor **202** may execute instructions to perform functions of the virtual inventory manager **108**, such as by accessing and passing shared inventory items to a virtual world simulator **102**, and may temporarily or permanently store information during its calculations or results after calculations in storage **204** or memory **206**. All or part of the virtual inventory manager **108**, for example, may be stored in memory **206** during execution of its routines. Similarly, processor **202** may execute instructions for the VU interface **112** when computer system **200** is used for a client computer system **106**.

The user interface adapter **208** may connect the processor **202** with user interface devices such as a mouse **220** or keyboard **222**. The user interface adapter **208** may also connect with other types of user input devices, such as touch pads, touch sensitive screens, electronic pens, microphones, etc. A user of a client computer system **106** attempting access to a shared inventory item, for example, may utilize the keyboard **222** and mouse **220** to interact with their computer system. The bus **212** may also connect the processor **202** to a display **214**, such as an LCD display or CRT monitor, via the display adapter **210**.

FIG. 3 depicts a conceptual illustration of software components of a virtual inventory manager **108** according to some embodiments. The virtual inventory manager **108** may be implemented on a computer system **200** such as described in relation to FIG. 2, including on one or more servers. The virtual inventory manager **108** may also alternatively be implemented as part of a virtual universe simulator **102** (i.e., executing on the same servers). As described previously and also in relation to FIG. 5, the virtual inventory manager **108** may manage shared inventory items for one or more virtual universe simulators **102** (and thus one or more virtual universes). The virtual inventory manager **108** may include components to assist it with its functions, including a user interface module **302**, a VU simulator interface module **304**, and a shared inventory enabler **310**. The shared inventory enabler **310** may include its own components, such as an inventory list module **312**, an inventory software module **314**, and a metadata manager module **318**. One of ordinary skill in the art will recognize that the functionality of each component of the virtual inventory manager **108** may be combined or divided in any fashion and the description herein is merely intended to be illustrative of some embodiments.

The user interface module **302** may facilitate communication to and from a user, including transmitting and receiving information associated with configuring an inventory item for sharing. For example, a user may request (and the user interface module **302** may receive) parameters for the sharing of a particular item, such as by limiting the other users who can access it, the length of time they may use it, or other limitation. The VU simulator interface module **304** may facilitate communication to and from virtual universe simulators **102**, such as by receiving notification of user sessions being established and requests for stored shared inventory items and by transmitting shared inventory items or metadata to a virtual universe simulator **102**.

The shared inventory enabler **310**, and its components, may communicate with the two interface modules to assist, it in performing its task of managing shared inventory items in a virtual universe (or multiple virtual universes). The inventory list module **312** may access a list of shared inventory items for the user upon receiving notification that the user has established a session with a virtual universe simulator **102**. The shared inventory item list may include one or more shared inventory items each having an inventory source (i.e., where the shared inventory item is located) associated with it. The inventory list module **312** may also retrieve updated listings for shared inventory items from their associated inventory sources and may also pass the updated shared inventory item list to the virtual universe simulator **102**. The inventory list module **312** may optionally establish or verify a connection with the various inventory sources as part of its task.

The inventory software module **314** may retrieve shared inventory items from its associated inventory source for passing to the virtual universe simulator **102**. The inventory software module **314** may access records of the location of particular shared inventory items in order to accomplish this task. To accomplish this, the inventory software module **314** may access a list of shared inventory items for the user that includes an inventory source for the items (such as the list updated by the inventory list module **312**). Using the shared inventory item list, the inventory software module **314** may retrieve the shared inventory items from their associated inventory source and may then pass the retrieved items to the virtual universe simulator **102** (via the VU simulator interface module **304**).

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The metadata manager module **318** may pass metadata for shared inventory items to the virtual universe simulator **102** to assist in controlling or limiting access to the shared inventory items. The metadata may include information relating to sharing of shared inventory items with users other than their owner. Metadata may be associated with a particular inventory item using any type of methodology. Metadata may, for example, mark an item for sharing by all, may mark the item for sharing with particular users, mark the item for sharing for particular users, etc. In other examples, metadata may mark an item for auction, barter, or other means of sharing items. In yet another example, metadata may mark an inventory item by a rating, such as a compilation of user ratings for the item. This example may be useful in facilitating a user searching for inventory items that meet a desired standard of quality or popularity (e.g., a user may request all “five star” or “10 out of 10” rated items). The metadata may be persisted to a database (such as the inventory source of the item or a separate metadata database) and may also be used for visual indication of whether an object is available for sharing.

The use of metadata may allow a virtual inventory manager **108** (through the metadata manager module **318**) to offer a variety of services. One service may provide for scheduling policies where the metadata includes an indication of a sharing scheduling policy that provides for use of a particular shared inventory item by different users at different times. An inventory owner may thus state that her items may be shared for predefined blocks of time (e.g., shared when owner not logged on, shared every evening between 6 and 10 p.m., etc.). Another service may provide for access control lists (ACLs) that allow owners to set up ACLs around which other members of the virtual universe may access the sharing status of a particular inventory item. A user may configure an ACL to, for example, specify that a particular other user to know that item A from their inventory is shareable but not to know that item B is similarly shareable with other users. Another inventory service the metadata manager module **318** may implement would include management of expiration of borrowing terms, such as by specifying a borrow time for an item. When the borrow time expires, a pop-up window or other notification could be used and renewal options could optionally be provided. One of ordinary skill in the art will recognize that metadata may be used to control or limit virtually every aspect of shared inventory items in a virtual universe.

FIG. 4 depicts an example of a flow chart **400** for rendering a shared inventory item in a virtual universe according to some embodiments. The method of flow chart **400** may be performed in one embodiment, by the virtual universe simulator **102**. Flow chart **400** begins with element **402**, establishing a session between a user and the virtual universe simulator **102**. In some embodiments, establishing a user session will involve the user providing authentication information (such as a password and user id) and the virtual universe simulator **102** authenticating the user and establishing the session. The virtual universe simulator **102** may then at element **404** notify a virtual inventory manager **108** of the newly established user session so that the virtual inventory manager **108** may perform its tasks.

The virtual universe simulator **102** may receive an updated shared inventory item list from the virtual inventory manager **108** at element **406** and may similarly receive a shared inventory item (and any metadata) from the virtual inventory manager **108** at element **408**. In some embodiments, the updated shared inventory items list is received first and the shared inventory item follows at a later time. For example, according to some embodiments, the item and metadata are not sent unless the user attempts to use the inventory item. In this

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example, the virtual universe simulator **102** would notify the virtual inventory manager **108** of the need to send the shared inventory item. In another example, all shared inventory items from the list are sent soon after the updated list. Alternatively, only the shared inventory items that are likely to be used (such as based on past history) are sent immediately and others are held back until needed. In yet another example, the virtual inventory manager **108** may send the shared inventory items and metadata for a first layer of subfolders in the inventory item hierarchy and the shared inventory items and metadata (and possibly listing) for lower tiers of subfolders in the hierarchy and are only sent if the user expands the folders below the first layer. One of ordinary skill in the art will recognize that the virtual universe simulator **102** and virtual inventory manager **108** may utilize any other known or later developed methodology for sending and displaying data from a remote source and apply these methodologies to the use of shared inventories.

During the user's session, the virtual universe simulator **102** may at element **410** receive a request from the user to use or otherwise access an item from their inventory list. At decision block **412**, the virtual universe simulator **102** may determine if the inventory item to be used is a shared inventory item. If the item is not a shared inventory item, the virtual universe simulator **102** may proceed to element **416** and render the inventory item for the user. If the item is a shared inventory item, the virtual universe simulator **102** may at decision block **414** determine if the item use is permitted based on airy metadata associated with the item. If item use is not permitted, the method may terminate and may optionally notify the user that use was denied and provide the reasons for the denial. If item use is permitted, the virtual universe simulator **102** may at element **416** render the shared inventory item for the user using the shared inventory item received, at element **408**. After rendering the inventory item and if the item is a shared virtual inventory item, the virtual universe simulator **102** may optionally notify the virtual inventory manager **108** of the use of the shared inventory item, after which the method terminates.

FIG. 5 depicts an example of a flow chart **500** for managing a shared inventory item in a virtual universe according to some embodiments. The method, of flow chart **500** may be performed, in one embodiment, by the virtual inventory manager **108** and its components and sub-components. Flow chart **500** begins with element **502**, storing any metadata for shared inventory items. The virtual inventory manager **108** may receive information from a user regarding inventory items they own at any time and may save metadata with the inventory item after receiving such information. As described previously, metadata may be stored with an inventory item at its inventory source, may be stored at a central location, or other location.

At element **504**, the virtual inventory manager **108** may receive notification of a user session from a virtual universe simulator **102**. The notification may include an identification of the user. Upon receiving the notification, the virtual inventory manager **108** may at element **506** access a list of shared inventory items for the user and their associated inventory sources. The virtual inventory manager **108** may then update information and retrieve each item on the list of shared inventory items. At element **508**, the virtual inventory manager **108** may connect to the first inventory source for shared inventory items (or alternatively ensure that a previous connection is still active). The virtual inventory manager **108** may then at element **510** retrieve updated listings for the shared inventory items stored on that particular inventory source and may also at element **512** retrieve the shared inventory items themselves

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and metadata for the shared inventory items. If there are more shared inventory items with different sources at decision block 514, the method returns to element 508 to repeat the process, in this fashion, all listings of inventory items may be updated for the user and any shared inventory items and metadata may also be retrieved.

The virtual inventory manager 108 may next at element 516 pass the updated shared inventory item list to the virtual universe simulator 102 and may also at element 518 pass the shared inventory item(s) to the virtual universe simulator 102. As described previously in relation to FIG. 4, the virtual inventory manager 108 may perform these tasks at different times and under different conditions, such as by delaying passing the shared inventory items until they are needed.

The virtual inventory manager 108 may at optional element 520 receive a notification of inventory item use by a user and, at element 522, may store an indication of such if required, after which the method terminates. Item use may be relevant in cases, for example, where the metadata for an inventory item provides that only a limited number of users can share at once, where the owner wants to know who shares the item, or in other situations.

FIG. 6 depicts an example of a flow chart 600 for using and configuring shared inventory items in a virtual universe according to some embodiments. The method of flow chart 600 may be performed, in one embodiment, by a user utilizing a VU interface 112 of a client computer system 106. Flow chart 600 begins with element 602, establishing a session with a virtual universe simulator 102, such as by providing valid authentication credentials.

Once the user is 'logged in' to the virtual universe, they may proceed in the virtual universe until accessing a list of the user's inventory items at element 604. The list of inventory items for the user may include both shared inventory items (i.e., owned by others) as well as inventory items owned by the user. The shared inventory items may optionally be indicated as shared by some means, such as an asterisk next to their name in the list or other visual indication. The user may at element 606 request the user of a particular inventory item and, at element 608, the virtual universe simulator 102 will render at the client computer system 106 the inventory item if permitted, as described: previously. From the point of the view of the user, using a permitted shared inventory item should be the same experience as using their own items according to some embodiments, providing a seamless use of shared inventory items by the user.

The VU interface 112 may receive from a user at element 610 a request to designate an inventory item that they own as a shared inventory item. The request may optionally include limitations to be implemented in metadata. If sharing of the item is permitted at decision block 612 (i.e., the user owns the item and it can be shared by its nature or virtual universe rules), the VU interface 112 may optionally generate metadata associated with the shared inventory item based on the user's request, default settings, or other information. The VU interface 112 may then transmit the request (and optional metadata) to either the virtual universe simulator 102 or virtual inventory manager 108 for processing.

FIG. 7 depicts a schematic representation of inventory source lists and an inventory item list with shared inventory items according to some embodiments. The inventory item model 700 of FIG. 7 includes a plurality of inventory source lists 702, 704, and 706 as well as two user inventory item lists 708, 710, as well as the relationships between them. Shareable items on any of the lists are marked with a leading asterisk. The inventory lists are also depicted in a hierarchical structure as is utilized according to some embodiments.

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Each inventory source list 702, 704, 706 may represent the contents of a particular inventory source, such as VU inventory database 111, distributed inventory database 118, local inventory database 114, etc. Each may also include a variety of folders, sub-folders, or files, some or all of which are marked as shared.

The user inventory item lists 708, 710 may represent the contents of the inventory for particular users of a virtual universe simulator 102. A user may have both shared inventory items and traditional inventory items and the difference between the two may not be visible to the user in some embodiments. In the depicted example, Anne's inventory list 708 has a number of items that are owned by her (e.g., red shirt, blue jeans) but other items that are shared from another source (e.g., U2song1.mp3, prognosisnegativetrailer\_video). For these shared items, the inventory list 708 may only have a pointer to the actual location of the content according to some embodiments and the disclosed system may provide the necessary code or other data to render those items as needed. One of Anne's items is also marked as shareable (the map of New York City) and Cliff is sharing that item in his inventory item list 710.

As can be seen from FIG. 7, a single inventory source may thus provide inventory items to a large amount of users and a particular user may have items in the inventory list from a wide variety of inventory sources, provided a flexible and scalable model for managing shared inventory items.

It will be apparent to those skilled in the art having the benefit of this disclosure that the present invention contemplates methods, systems, and media for managing shared inventory items in a virtual universe. It is understood that the form of the invention shown and described in the detailed description and the drawings are to be taken merely as examples. It is intended that the following claims be interpreted broadly to embrace all the variations of the example embodiments disclosed.

What is claimed is:

1. A method for managing shared inventory in a virtual universe, said method comprising:
  - receiving, by a processor of a computer system, an owner request from an owner of an inventory item to designate the inventory item as a shared inventory item, said owner request specifying terms and conditions under which the inventory item may be shared for use by users other than the owner;
  - in response to said receiving the owner request, said processor generating metadata comprising the terms and conditions;
  - said processor storing the metadata in a database of the computer system;
  - after said storing the metadata, said processor establishing a user session with a particular user who is not the owner;
  - after said establishing the user session, said processor both receiving a user request from the particular user to use the shared inventory item and receiving the metadata from the database;
  - said processor ascertaining that the terms and conditions in the received metadata permit the particular user to use the shared inventory item; and
  - in response to said ascertaining, said processor rendering the shared inventory item for use of the shared inventory item by the particular user.
2. The method of claim 1, said method further comprising:
  - after said establishing the user session and before said receiving the user request, said processor receiving an updated list of inventory items, wherein one inventory



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item on the list is marked with a text character denoting that the one inventory item is shareable with users other than an owner of the one inventory item, and wherein another inventory item on the list is not marked to denote that the another inventory item is shareable with users other than an owner of the another inventory item.

3. The method of claim 1, wherein the terms and conditions in the metadata specify a rating denoting a standard of quality for the shared inventory item and that the shared inventory item may be shared for use by users who specify a desired quality for the shared inventory item not exceeding the standard of quality denoted by the rating.

4. The method of claim 1, wherein the terms and conditions in the metadata specify that the shared inventory item may be simultaneously shared for use by no more than a specified maximum number of users.

5. The method of claim 1, wherein the terms and conditions in the metadata specify that the shared inventory item may be shared for use by different users at different times.

6. The method of claim 1, wherein the terms and conditions in the metadata specify that the shared inventory item may be shared for use only when the owner is not logged on the computer system.

7. The method of claim 1, wherein the terms and conditions in the metadata specify that the shared inventory item may be shared for use during only a specified period of time during each day.

8. The method of claim 1, wherein the terms and conditions in the metadata specify that the shared inventory item may be shared for use by only particular users.

9. The method of claim 1, wherein the terms and conditions in the metadata specify that the shared inventory item may be shared for use in an auction.

10. The method of claim 1, wherein the terms and conditions in the metadata specify that the shared inventory item may be shared for use in barter activity.

11. A computer program product, comprising a computer readable tangible storage device having computer readable program code stored therein, said program code configured to be executed by a processor of a computer system to implement a method for managing shared inventory in a virtual universe, said method comprising:

said processor receiving an owner request from an owner of an inventory item to designate the inventory item as a shared inventory item, said owner request specifying terms and conditions under which the inventory item may be shared for use by users other than the owner;

in response to said receiving the owner request, said processor generating metadata comprising the terms and conditions;

said processor storing the metadata in a database of the computer system;

after said storing the metadata, said processor establishing a user session with a particular user who is not the owner;

after said establishing the user session, said processor both receiving a user request from the particular user to use the shared inventory item and receiving the metadata from the database;

said processor ascertaining that the terms and conditions in the received metadata permit the particular user to use the shared inventory item; and

in response to said ascertaining, said processor rendering the shared inventory item for use of the shared inventory item by the particular user.

12. The computer program product of claim 11, said method further comprising:

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after said establishing the user session and before said receiving the user request, said processor receiving an updated list of inventory items, wherein one inventory item on the list is marked with a text character denoting that the one inventory item is shareable with users other than an owner of the one inventory item, and wherein another inventory item on the list is not marked to denote that the another inventory item is shareable with users other than an owner of the another inventory item.

13. The computer program product of claim 11, wherein the terms and conditions in the metadata specify a rating denoting a standard of quality for the shared inventory item and that the shared inventory item may be shared for use by users who specify a desired quality for the shared inventory item not exceeding the standard of quality denoted by the rating.

14. The computer program product of claim 11, wherein the terms and conditions in the metadata specify that the shared inventory item may be simultaneously shared for use by no more than a specified maximum number of users.

15. The computer program product of claim 11, wherein the terms and conditions in the metadata specify that the shared inventory item may be shared for use by different users at different times.

16. The computer program product of claim 11, wherein the terms and conditions in the metadata specify that the shared inventory item may be shared for use only when the owner is not logged on the computer system.

17. A computer system comprising a processor, a memory coupled to the processor, and a computer readable tangible storage device coupled to the processor, said storage device containing program code configured to be executed by the processor via the memory to implement a method for managing shared inventory in a virtual universe, said method comprising:

said processor receiving an owner request from an owner of an inventory item to designate the inventory item as a shared inventory item, said owner request specifying terms and conditions under which the inventory item may be shared for use by users other than the owner;

in response to said receiving the owner request, said processor generating metadata comprising the terms and conditions;

said processor storing the metadata in a database of the computer system;

after said storing the metadata, said processor establishing a user session with a particular user who is not the owner;

after said establishing the user session, said processor both receiving a user request from the particular user to use the shared inventory item and receiving the metadata from the database;

said processor ascertaining that the terms and conditions in the received metadata permit the particular user to use the shared inventory item; and

in response to said ascertaining, said processor rendering the shared inventory item for use of the shared inventory item by the particular user.

18. The computer system of claim 17, said method further comprising:

after said establishing the user session and before said receiving the user request, said processor receiving an updated list of inventory items, wherein one inventory item on the list is marked with a text character denoting that the one inventory item is shareable with users other than an owner of the one inventory item, and wherein another inventory item on the list is not marked to denote

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that the another inventory item is shareable with users other than an owner of the another inventory item.

19. The computer system of claim 17, wherein the terms and conditions in the metadata specify a rating denoting a standard of quality for the shared inventory item and that the shared inventory item may be shared for use by users who specify a desired quality for the shared inventory item not exceeding the standard of quality denoted by the rating. 5

20. The computer system of claim 17, wherein the terms and conditions in the metadata specify that the shared inventory item may be simultaneously shared for use by no more than a specified maximum number of users. 10

21. The computer system of claim 17, wherein the terms and conditions in the metadata specify that the shared inventory item may be shared for use by different users at different times. 15

22. The computer system of claim 17, wherein the terms and conditions in the metadata specify that the shared inventory item may be shared for use only when the owner is not logged on the computer system. 20

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